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ST. ONGE STEWARD JOHNSTON & REENS, LLC
986 BEDFORD STREET
STAMFORD, CT 06905-5619

EXAMINER	
MACARTHUR, SYLVIA	

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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 10/751,390
Filing Date: January 05, 2004
Appellant(s): KAEPPELER, JOHANNES

Wesley W. Whitmyer, Jr.
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed October 31, 2007 appealing from the Office action mailed June 5, 2007.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

US Patent Number	Inventor Name	Publication Date
5,788,777	Burk, Jr	08-1998
6,740,167	Rupp et al	05-2004
2001/0052324	Rupp et al	12-2001

Other References:

Arne Standness. "The Electrical Conductivity of the Elements Table" taken from <u>www.standnes.no/chemix/periodictable/electrical-conductivity-elements.htm published Sept. 1997</u>

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

A) Claims 1,3, 8, 10,11, 14, and 17 - 19 are rejected under 35 U.S.C. 102(b) as being anticipated by Rupp et al (US 2001/0052324, henceforth known as Rupp et al '324) or, in the alternative, under 35 U.S.C. 103(a) as obvious over Rupp et al '324 as evidenced by "The Electrical Conductivity of the Elements Table".

Rupp et al '324 teaches a device that produces and processes semiconductor substrates.

Regarding claims 1, 18, and 19: The device can inherently be used to deposit particular crystalline layers on an in particular substrate having an HF heated substrate holder (susceptor 1) see Fig.2 wherein the susceptor is heated by HF coils 4 by electrical conduction. Note that how the device is used and how the holder is heated are interpreted as matters of an intended use, though Rupp et al '324 provides the teachings of HF heating coils/electrical conduction.

The holder holds the substrate with surface to surface contact, as it has a zone (cutout 6) having a higher electrical conductivity than the SiC coated susceptor 5. Note that the cut-out 6 substantially corresponds (in size and shape) to the supported surface of the substrate. Though, Rupp et al does not specifically teach that the materials of construction between the insert and the susceptor differ basis electrical conductivity, it is noted that electrical conductivity is a physical property that is inherent to materials of construction. Rupp et al teaches that the insert 2 (zone 1) is made of a metal while the susceptor is made of coated graphite, see col. 4 lines 43-59 and col. 5 lines 44-52.

If the relationship between the temperature zones and temperature variation is not inherent relative to the materials of construction, it would have been obvious basis evidence from The Electrical Conductivity of the Elements Table. The table provides evidence that graphite (C) has an electrical conductivity of 0 while the appellant's preferred materials Ta (0.076), Mo (0.187) and W (0.189), the recited values are x 10^6 $Ohm^{-1}cm^{-1}$. Thus, the insert made of any of these metals (Ta, Mo, or W) inherently comprises a higher electrical conductivity than graphite (carbon, C); see Rupp et al '324 [0034] and [0038].

Regarding the temperature zones, first and second zones, and their respective surface temperatures, t_1 and t_2, Rupp et al fails to specifically recite a difference in temperature.

However, the examiner asserts that this temperature variation is inherent due to the use of different material of construction between the insert and the substrate holder. It is noted that the examiner's position is supported by the specification (page 2 [007]) of the present invention that when a substrate holder comprises two differing zones of electrical conductivity where the zone of higher electrical conductivity is taken up (directly supported by) the substrate and is formed of a metal that zone is ensured to have a hotter temperature than the zone of lower electrical conductivity. Note, the specification recites metals such as tungsten, tantalum or molybdenum as the materials of construction of the insert and the material of construction of the holder as graphite see page 3 [0007] and [0017] respectively.

It is the materials of construction that drive the temperature variation. Furthermore, since the materials of the present invention and the prior art are the same; it is inherent that the difference in electrical conductivity of the zones and their respective temperatures is the same.

Regarding claim 3: Section [0034] recites that the susceptor 1 is made of a metal. Note that the non-coated material used to construct the susceptor is the same material of the cut-out while all other portions of the susceptor are coated with covering 5 see [0036].

Regarding claim 8: Section [0034] recites that the insert is made of Mo. Ta, or W.

Regarding claim 10: The holder is above the HF coil 4 see Fig. 2

Regarding claim 11: Section [0046] recites that the device of Rupp et al is used in hot wall or cold wall reactors; Fig. 2 illustrates a cold wall reactor wherein heat is distributed to the walls only by the radiation of the heated substrate holder 1.

Regarding claim 14: Rupp et al '324 teaches a holder 1, a HF heater 4, a first holder zone (cut-out 6) and a second substrate holder zone 5 (covering). Metals have a high electrical

conductivity relative to non-metals and semiconductors. Note that the cut-out 6 substantially corresponds (in size and shape) to the area taken up by the substrate.

Regarding claim 17: [0034] recites that the insert is made of Mo. Ta, or W.

Regarding claims 18 and 19: Note that the first substra te holder zone having a higher electrical conductivity inherently has an increased amount of energy transferred to the substrate as this corresponds to the definition of electrical conduction being the ease which electric current (a demonstration of energy movement) can pass through a material.

B) Claims 9 and 12 rejected under 35 U.S.C. 103(a) as being unpatentable over Rupp et al ('324).

The teachings of Rupp et al ('324) were discussed above, specifically the embodiment illustrated and described by Fig. 2.

Regarding claim 9: Fig. 2 fails to teach that the holder is surrounded by an HF coil. Fig. 1 illustrates an embodiment wherein the holder is arranged in a tube wherein the HF coil surrounds the tube and thus surrounds the holder. The motivation to surround the holder with the HF coil is that the holder can be inductively heater and the holder is heater uniformly on all sides, see [0033] of Rupp et al ('324). Thus, it would have been obvious for one of ordinary skill in the art at the time of the claimed invention to provide HF coil to surround the holder so as to provide uniform heating over all the surfaces of the holder.

Regarding claim 12: Fig.2 fails to teach a tunnel reactor.

Figure 1 of Rupp et al (US 2001/00523324) recites a tunnel (synonymous with tube reactor) reactor according to Section [0033]. The motivation to use a tunnel reactor is that the

tubular shape shields the chamber atmosphere of the process gases according to [0033] of Rupp et al US 2001/0052324. Thus, it would have been obvious for one of ordinary skill in the art at the time of the claimed invention to use a tunnel reactor as illustrated in Fig.1 as it shields the chamber atmosphere from the process gases.

C) Claim 1, 8, 10, 11, 14, and 17-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rupp et al (US 6,740,167, henceforth known as '167) in view of Burk, Jr. et al (US 5,788,777).

Rupp et al ('167) teaches a device for mounting a substrate. The device includes an insert 2 (zone) made of a metal carbide layer and a susceptor 1 (made of graphite). The wafer is supported in surface to surface contact with the insert such that it substantially corresponds to the supported surface of the substrate.

Regarding claims 1, 18 and 19: Rupp et al '167 fails to teach a heater or how the holder is heated.

Burk, Jr. et al teaches a susceptor 20 wherein rf (a form of HF) coils are provided to heat the holder 20. Col. 2 lines 36-42 recite that the heater 28 is provided (the motivation of using the heater) is to establish the required process temperature of the substrate. Additionally, the motivation to provide the susceptor of Rupp et al '167 with the heater 28 is to ensure that the substrate can maintain the required process temperature. Thus, it would have been obvious for one of ordinary skill in the art at the time of the claimed invention to provide the RF coils of Burk, Jr. et al. Regarding the temperature zones, though Rupp et al fails to specifically recite a difference in temperature, the examiner asserts that this temperature variation is inherent. It is further the examiner's position as supported by the specification (page 2 [007]) of the present

invention that when a substrate holder comprises two differing zones of electrical conductivity where the zone of higher electrical conductivity is taken up (directly supported by) the substrate and is formed of a metal that zone is ensured to have a hotter temperature than the zone of lower electrical conductivity. It is the materials of construction that drive the temperature variation. Since the materials of the present invention and the prior art are the same. It is inherent that the difference in electrical conduction and temperature is the same. Rupp et al ('167) teaches a susceptor of graphite, see col. 4 lines 43-59 and inserts of metals tantalum, molybdenum, and tungsten see col.5 lines 10-17. Rupp et al ('324) teaches the susceptor 5 is made of metal carbides over graphite see [0036] and insert 1 made of metals molybdenum or tungsten see [0034]. Note in both prior art reference to Rupp et al the insert (first zone) corresponds to an area supported by the substrate.

Regarding claim 8: The insert piece 2 consist of TaC, MoC, WC according to col. 2 lines 60-64 of Rupp et al '167.

Regarding claim 10: Burk, Jr. et al illustrates that the holder is above the RF coils 28.

Regarding claim 11: The reactor of Burk, Jr. et al is a cold wall reactor, wherein heat is distributed to the walls only by the radiation of the heated substrate holder 20, see Fig.1.

Regarding claim 14: Rupp et al '167 teaches a holder 1, a first holder zone (insert 2) and a second substrate holder zone 1 (susceptor). Metals have a high electrical conductivity relative to non-metals and semiconductors. Note that the insert 2 substantially corresponds (in size and shape) to area taken up by the substrate

Rupp et al '167 fails to a HF heater.

Burk, Jr. et al (US 5,788,777) teaches a susceptor 20 wherein rf (a form of HF) coils are provided to heat the holder 20. Col. 2 lines 36-42 recite that the heater 28 is provided to establish the required process temperature of the substrate. Thus, the motivation to provide the susceptor of Rupp et al '167 with the heater 28 is to ensure that the substrate can maintain the required process temperature. Thus, it would have been obvious for one of ordinary skill in the art at the time of the claimed invention to provide the RF coils of Burk, Jr. et al.

Regarding claim 15: The first zone (insert 2) is formed by a metal carbide (made of a metallic perform) that is insertable into the holder 1, see the abstract.

Regarding claim 16: The insert of Rupp et al ('167) comprises coated graphite, col. 3 lines 3-14.

Regarding claim 17: The insert piece 2 consist of TaC, MoC, WC according to col. 2 lines 60-64 of Rupp et al '167.

Regarding claims 18 and 19: Note that the first substra te holder zone having a higher electrical conductivity inherently has an increased amount of energy transferred to the substrate as this corresponds to the definition of electrical conduction being the ease which electric current (a demonstration of energy movement) can pass through a material.

D) Claims 4-7 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Burk, Jr. et al (US 5,788,777) in view of Rupp et al '167 or Rupp et al (US 2001/00523324).

Burk, Jr. et al teaches a susceptor 20 wherein rf (a form of HF) coils are provided to heat the holder 20. Col. 2 lines 36-42 recite that the heater 28 is provided to establish the required process temperature of the substrate, see Figs. 1, 4,5, 7, 7A, and &B..

Regarding claim 4: Burk, Jr. et al teaches that the holder 20/86 has a plurality of substrate bearing disks which are mounted on a gas bearing and each having an insert piece 22/90.

Regarding claim 5: The disks 86 consist of metal, specifically graphite according to col. 4 lines 10-25 of Burk, Jr. et al.

Regarding claim 6: Figs. 4 and 5 illustrate that the disks are disposed in a planetary fashion.

Regarding claim 7: Located in substrate bearing disk is located a gas bearing in a bearing recess, see Figs. 1. 7, 7A, and 7B.

Regarding claim 13: Gas enters the reactor via pipe 36, 92 according to col. 4 lines 10-25.

Burk, Jr. et al fails to teach neither the insert piece has zone of higher electrical conductivity nor that the insert is made of metal.

Rupp et al '167 teaches a wafer supported by a susceptor 1 that includes an insert 2 wherein the wafer is in surface to surface contact with the insert. Rupp et al '167 teaches in col. 2 lines 49-64 the advantage of incorporating a high temperature region (zone) in the susceptor with the motivation that such zones ensure that no contamination from the susceptor will diffuse into the substrate. Thus, it would have been obvious to construct the susceptor of Burk, Jr. et al wherein the area 22 that is in surface to surface contact with the wafer is made of a material of higher electrical conductivity such as a metal carbide.

Likewise, Rupp et al (US 2001/0052324) teaches a holder that holds the substrate with surface to surface contact, the holder has a zone (cutout 6) has a higher electrical conductivity that the SiC coated susceptor 5. Note that the cut-out 6 substantially corresponds (in size and

shape) to the supported surface of the substrate. The abstract teaches that the motivation to construct the device of Rupp et al in this fashion so to ensure that no contamination of the substrate during the production process. Thus, it would have been obvious to construct the susceptor of Burk et al wherein the area 6 (cut-out) that is in surface to surface contact with the substrate is made of a different material that the other portions of the susceptor. Though, Rupp et al does not specifically teach that the difference in the material of construction between the covering 5 and the susceptor cutout 6 is basis electrical conductivity it is noted that Ta, W, and Mo are materials with a higher electrical conductivity than (graphite, C or silicon, Si) as evidenced by *The Electrical Conductivity of the Elements Table.* Thus, it would have been obvious to construct the susceptor of Burk, Jr. et al wherein the area 22 that is in surface to surface contact with the wafer is made of a material of higher electrical conductivity such as a metal carbide.

(10) Response to Argument

A) Rupp et al '324 fails to anticipate or fairly suggest a substrate holder with two temperature zones where the first is a higher temperature than the second as interpreted from the excerpt of Rupp et al [022]. Upon review of that section it is noted that Rupp et al explains that when a SiC substrate is used the temperature distribution on the substrate and its immediate vicinity is more homogeneous. The present invention is held to a substrate holder/second zone made of a material of a particular electrical conductivity (covering 5 consisting of SiC or metal carbides) and an insert/first zone (susceptor 1, consisting of graphite, molybdenum, tantalum,

and tungsten), corresponding to an area of supported surface of the substrate and made of another material of construction with a different, higher electrical conductivity. The material of construction of the substrate or workpiece used in Rupp et al does not negate that it teaches a holder consisting of two zones (insert, uncoated area) and the rest of the holder (coated area). Recall that the basis of the zones here is the use of different materials of construction which will have different electrical conductivities as supported by the specification of the present invention, specification, page 2 section [007]. Further note that if appellant maintains that the prior art of Rupp et al fails to anticipate the temperature zones. An obvious rejection was also made in the alternative, wherein the temperature zones are deemed obvious as they depend on the chosen materials of construction of the two areas on the holder. The selection of a known material based on its suitability for its intended use is prima facie obviousness. See Sinclair & Carrol Co. v. Interchemical Corp., 325 US 327, 65 USPQ 297 (1945).

B) Rupp et al '167 fails to teach a substrate holder with two temperature zones where the first is a higher temperature than the second. Recall Rupp et al '167 teaches a susceptor made of graphite and an insert made of tantalum, molybdenum, and tungsten see col. 4 lines 46-50 and col. 5 lines 3-16. just as appellant recites a disk 4 made of graphite and an insert made of molybdenum see page 5 section [00017].

C) Appellant further argues on page 10 first full paragraph that the susceptor is the entire frame and should not be construed as a substrate holder as no portion of the susceptor contacts the substrate, but rather it is the overall structure that supports the substrate holder. Appellant then argues that the substrate never comes in contact with or is associated with the susceptor. The

examiner connotes the susceptor as a substrate holder (in that at least a portion supports the substrate) comprising a body 1 and an insert 2 (which is a depression formed in the body 1 see col. 4 lines 60-65). Note Fig. 1 of Rupp et al '167 should be compared with Fig. 6 of the present invention.

C) Appellant argues the motivation of combining Burk, Jr. and Rupp et al '167. It is noted that the prior art of Rupp et al teaches that the substrate is heated in Rupp et al see col. 1 lines 42-54 and col. 4 lines 45-59, but fails teach how the substrate is heated other than induction heating. The teachings of Burk, Jr are provided to show that it is conventional to use high frequency heating via heating coils 28, see Fig.1. This type of heating is known as taught by Burk, Jr to provide a means of heating that will ensure that the substrate will be heated to the desired process temperature. The motivation statement was not used to insinuate that the prior art of Rupp et al '167 could not also reach the desired temperature, but it was noted that Rupp et al '167 only taught heating in brief and did not provide a structure for the heater.

(11) Related Proceeding(s) Appendix

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

9913Primary Examiner Sylvia R. MacArthur

Conferees:

TQAS Gregory Mills

SPE Parviz Hassanzadeh